

- 1 -

Job 646
WCM
21 May 1971

Interim Report
Cure of Vibration Difficulties
with Optical Equipment

Period of Report from initiation of contract (15 April 71)
through 21 May 1971

1.0 General

1.1 An initial meeting was held on 20 April 71, thru
23 April 71 resulting in choices of equipment
for investigation, and a meeting with
 resulting in an
understanding of the ambient vibration data
to be made available. STAT

1.2 From 26 April 71 through 15 May 71 the
contractor devised equipment to be
used in the vibration difficulty investigation.

1.3 The investigation at the site was
initiated on 17 May 1971. The first
three days were largely concerned with
setting up and checking instruments, and
familiarization with the equipment.

1.4. An investigation of a 10X, 20X, 40X Enlarger
was made during 19, 20 & 21 May 1971.

Interim Report - Vibration Difficulties Job 646
WCM
21 May 1971

2.0 Investigation of 10X20X40X Enlarger S/N-3

2.1 Ambient Floor Vibration Input

The floor vibration level was amazingly high in the room at Enlarger S/N-3. A spectrum analysis (manual sweep) was made in order to understand the reason for the unusually high disturbance.

Dominant peaks were found as follows:;
 (probable sources are noted)

<u>Peak to Peak</u> <u>excursion</u> <u>microinches</u>	<u>Frequency</u>	<u>Probable source</u>
- no estimate -	4 to 7 cps	Basic Enlarger resonance reflected in floor
8 to 10	12 cps	- not identified -
13	28 to 30 cps	1725 to 1800 RPM Electric motors
3.	55 to 65 cps	60 cycle "hum" from motor & brake field coils
3.	115 to 120 cps	Transformer "hum" from many small units or one large unit. Probably from fluorescent light ballasts.

Interim Report - Vibration Difficulties

WCM
29 May 1971

2.1 (cont.) 10X20X40 Enlarger

Normal levels are $\frac{1}{2}$ to $\frac{1}{4}$ these levels.

2.2. Response of Enlarger to floor Ambient

a similar manual spectrum analysis was made on the base of the machine which is isolated. At the lower frequencies (up to 30 cps) we found some magnification of levels. Obviously the vibration isolation is not effective at low frequencies as expected.

2.3 Self Induced Vibration

Considerable 60 cps & 120 cps disturbance was discovered throughout the unit from base to lens mount and easel. This was ~~traced~~ traced to field coils of the electric motors and brakes, as with power "off" the level dropped to less than $\frac{1}{4}$. These are motors for the film drive and brakes which lock the platen position.

- 4 -

Job 646
WCM
21 May 1971

Interim Report - Vibrations/Difficulties2.4 Optical axis excursion

Measurements of lens mount and easel were made which are to allow an estimate of image motion resulting from ambient vibration input. It was discovered that ambient vibration varies throughout the day probably as much as a factor of 4X. Also very large shocks occur on occasion. We audibly correlated them with door closings, conveyor operation, and personnell climbing a steel staircase.

Using the highest average levels we made a very rough calculation of optical axis excursion from amplitude differences front to back on the lens mount. This resulted in $\frac{1}{150}$ mm to $\frac{1}{200}$ mm motions. Smear of this magnitude would limit performance at 40X magnifications. Better estimates will be made with further data reduction.

-5-

Interim Report - Vibration Difficulties

Job 646
WCM
21 May 1971

3.0 Program Next period

Use predicted ambient data &
drive floors at these levels at the
instruments to determine response
and optical effect



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